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Agricultural Research

U.S. DEPT. OF AGRICULTURE

The Structure of Agriculture— A Look Ahead

Bob Bergland
Secretary of Agriculture

The structure of American agriculture — how farming is organized, who controls it, and where it is heading — has been a source of concern for more than three decades.

We have lost over half our farms since 1940; average farm size has more than doubled; and control of agriculture's productive resources has been concentrated, bit by bit, in fewer and fewer hands.

Of the more than 2 million farms counted by the 1974 agricultural census, 200,000 now produce nearly two-thirds of the Nation's food and fiber. Agriculture's marketing system has become increasingly geared to large-scale producers, as have the businesses that sell fertilizers, seeds, and other materials to farm operators. Spiraling land prices are a barrier to beginning farmers and do much to turn agriculture into a restricted profession.

These developments have been part of an agricultural revolution that has boosted productivity dramatically. The benefits to the national economy, to consumers, and to many farmers as well, have been enormous. But the cost has also been high, especially in rural areas where the price was frequently measured in terms of dwindling populations, dying small-town businesses, and a vanishing way of life.

We have few programs today that deal specifically with farm structure and no comprehensive policy on the subject at all.

Most of the income benefits from traditional commodity programs, for example, go to the largest producers. Our tax laws have favored larger operations and encouraged outside investment in agriculture. And our credit system may well have fostered a kind of economic cannibalism within agriculture by giving aggressive operators the means to buy out their neighbors.

These circumstances disturb me greatly, as they do many other Americans. Recently, however, this rate of change in U.S. farming has eased, and today we have an opportunity to anticipate the future.

During November and December, I participated in a national dialogue on farm structure at ten public meetings across the country. I personally heard the concerns of people across the Nation on the type of structure and policy that can best meet the needs of farmers, rural communities, and the American public in the years to come.

If you or your organization did not attend one of these meetings, or later develop ideas or positions, submit your views or factual information to the Project Coordinator, Structure of Agriculture, U.S. Department of Agriculture, Washington, D.C. 20250.

To be successful and truly represent public opinion, this dialogue needs the widest possible participation. It will give us a better understanding of our choices and enable us to select wisely among them as we plan for the structure of American agriculture.

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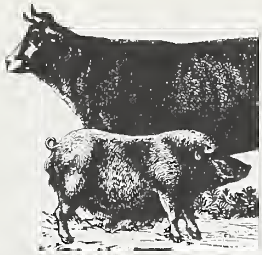
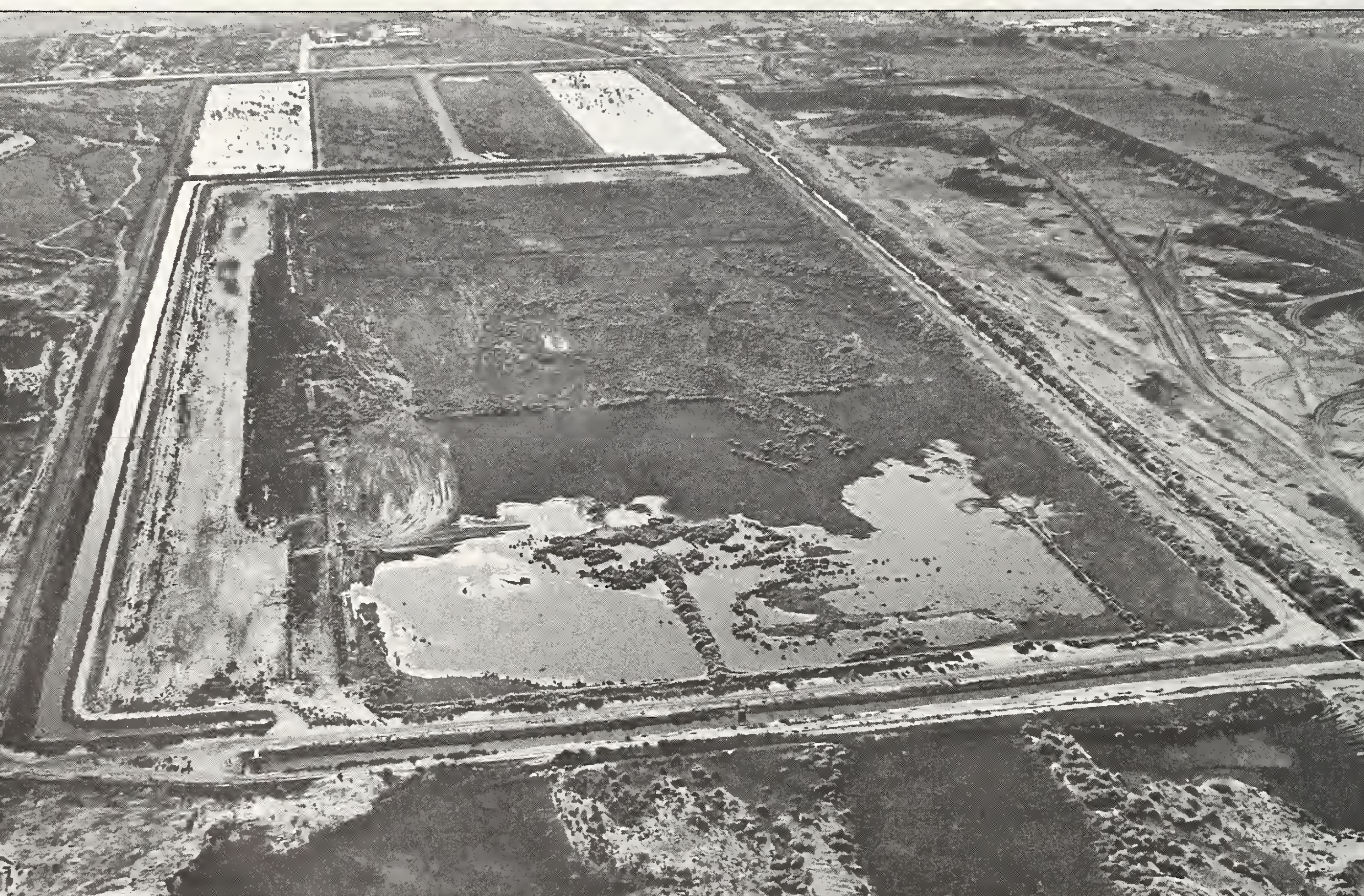
Illustrations for Crops, Marketing, Plant Science, and Agrisearch Notes: p.2 Tree; p. 123 Broccoli; p.214 "The Bonnet"; p.294 "Experiments in Water-culture" in *Food Gardens* by Tom Riker and Harvey Rottenberg.
Copyright © 1975 by Tom Riker and Harvey Rottenberg. By permission of William Morrow & Company.

Photo on p. 12 courtesy Grant Heilman.

Photos on pp. 8, 9 and 10 courtesy Wayne Romp, NADC Photography Unit.

Cover: Sewage effluent purified by land filtration—a research goal of SEA's Water Conservation Laboratory in Phoenix—renovates water for irrigation and recreational use, and could cut treatment costs nationally by an estimated $80 million a year—our story begins on page 4 (0876X1103-26A).





Recycling Waste Water—From City to Farm

Farmers and city dwellers could benefit from agriculture playing an increased role in utilizing the nation's wastewater. Applying sewage water to land could cut treatment costs nationally by about $80 million a year, says Herman Bouwer, director of the SEA U.S. Water Conservation Laboratory in Phoenix.

Bouwer, a hydraulic engineer, has been working with land treatment of sewage from municipal treatment plants for the past 12 years.

Sewage is dirty water. Cleaning it so that it can be safely discharged into lakes and streams takes money and energy.

Treatment of primary and secondary domestic sewage in the U.S.—about 20 billion gallons a day—costs about $1.5 billion per year, based on treatment costs at 20 cents per 1,000 gallons. One expert estimates that electricity needed to treat that amount of sewage is nearly 2 percent of all the electricity generated in this country.

In quite a few instances, tertiary or advanced wastewater treatment is also necessary to protect the quality of the receiving waters. Current tertiary treatment more than doubles the costs and greatly increases energy consumption relative to primary and secondary treatment.

- Primary treatment is a sedimentation process that removes everything that floats and sinks.
- Secondary treatment is a biological process in which bacteria digest dissolved or suspended organic waste matter in aerated tanks or rock beds.
- Tertiary treatment consists of physical and chemical processes to remove nitrogen, phosphorus, organic carbon, bacteria, and viruses.

"But, the high degrees of sewage treatment and resulting high costs are not always necessary," Bouwer says. "Many towns and cities could take advantage of the lesser treatment requirements made possible by applying sewage effluent to land instead of discharging it into surface water.

Above: Bouwer inspects this typical geological profile near the infiltration basins. The sand and gravel layers form a natural filter for sewage effluent percolating down to groundwater (0476X414-32).

Opposite, Top: Phoenix's initial rapid-infiltration system, built in 1975, was ineffective because algae grew rapidly in the 80-acre oxidation pond on the right. When algae-laden water flowed into infiltration basins on the left, it clogged the basin's soil and reduced infiltration rates (0476X411-30).

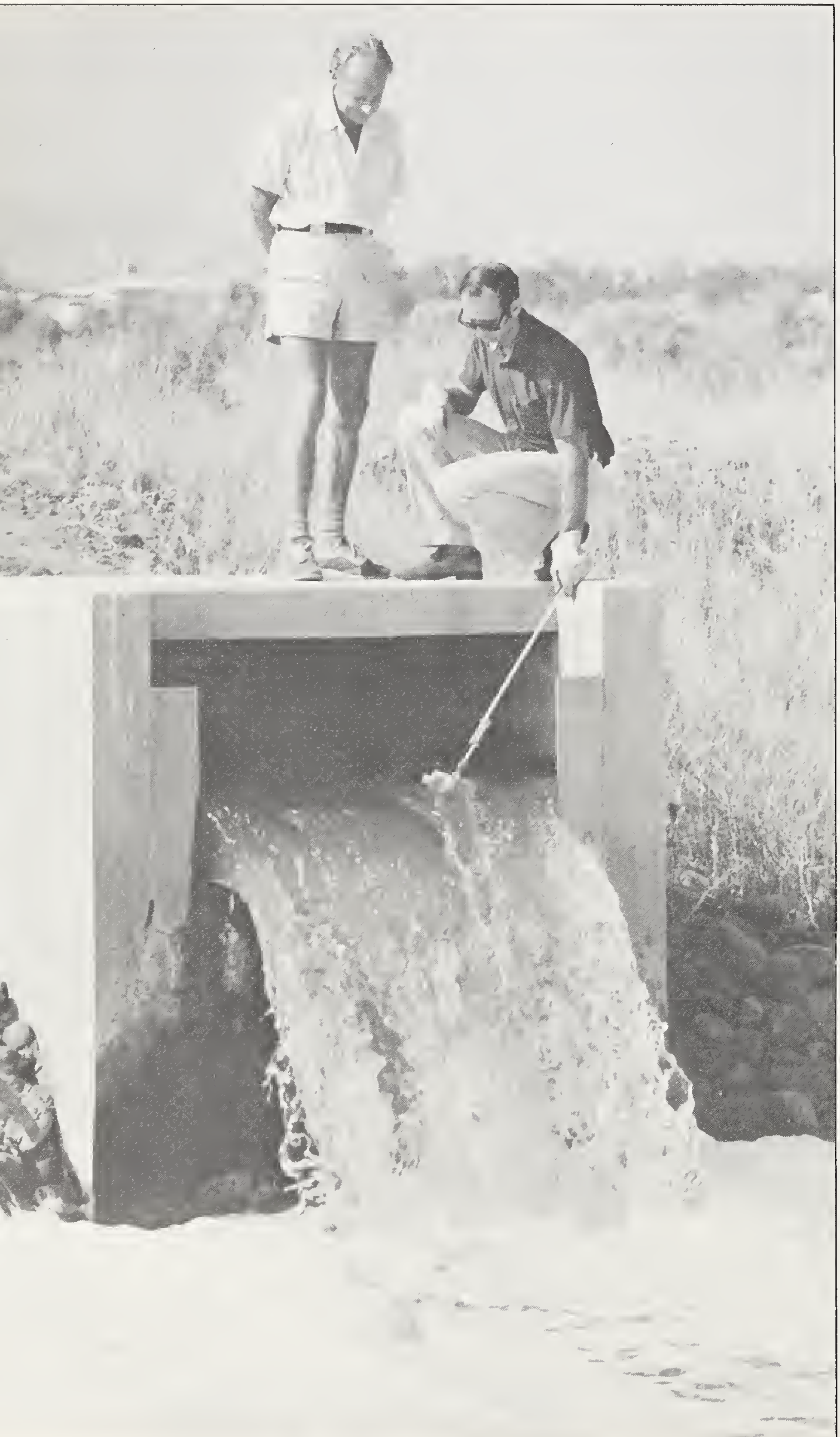
Opposite, Bottom: The new system, with a bypass channel around the pond, prevents algae growth and gets secondary effluent from the Phoenix sewage treatment plant directly into the four 10-acre basins. This increases infiltration rates 4 times and capacity to 12 million gallons of secondary effluent daily (0979X1330-30).

"Crops could be grown that would use nitrogen, phosphorus, and other 'pollutants' in the effluent as fertilizer—crops eaten raw by people should be avoided," he adds.

Irrigation Benefits

Where rainfall is insufficient, the sewage would also have irrigation benefits. Land-applied sewage water not evaporated by crops seeps deep into the ground and eventually joins underlying groundwater.

Since physical, chemical, and biological processes in the soil remove a lot of the impurities in sewage, the effect of well-managed, sewage-irrigated fields on groundwater is about the same as that of normally farmed or irrigated fields.



The ability of soil to act as a natural filter for purifying sewage water is deliberately used in so-called rapid-infiltration systems. These are essentially groundwater recharge systems where sewage effluent seeps into the ground from specially constructed infiltration basins. Crops normally are not grown in the basins.

After the effluent filters down to the groundwater, it becomes purified or "renovated" water that can be pumped from wells for reuse.

Where groundwater is shallow, renovated water can also be collected with tile drains or it can drain naturally into nearby surface water. These systems require permeable soils.

The prime purpose of infiltration is to upgrade sewage water before discharging it into surface water. After infiltration, the water is also suitable for irrigation of crops eaten raw by humans, or crops whose quality or harvest-ability are unfavorably affected by too much nitrogen in the effluent.

Research Findings

"Our research at Phoenix shows that rapid-infiltration systems in the Salt River bed can take effluent at a rate of about 200 feet per year and remove more than 60 percent of the nitrogen.

"Bacteria, viruses, and suspended solids are completely removed, leaving a clear, odorless water that can be used for unrestricted irrigation or for recreational lakes. The cost of putting the effluent underground and pumping it as renovated water from wells is a fraction of the cost of an equivalent third stage treatment," Bouwer says.

The great advantage of rapid-infiltration and certain other land-treatment systems is that they can take well-settled primary effluent, thus eliminating the

Agricultural engineer Robert C. Rice (kneeling) and Bouwer collect a secondary sewage sample for chemical and bacteriological analysis. Effluent flows from the bypass channel into infiltration basins through rectangular weirs which measure flow rate (0879X1101-18).

need for the costly and energy intensive secondary treatment.

"This is very important if we consider that primary treatment costs are only one-third to one-half as much as primary-secondary (activated sludge) treatment combined, and requires only about one-fifth as much electrical energy," he added.

Millions Saved

"On a national basis, this could save millions of dollars in treatment costs. Let's assume, for example, that sewage production is 100 gallons per person per day. This produces about 24 million acre-feet of effluent per year for the entire country. Assuming that land conditions around cities and towns are such that only 20 percent of this volume can be used for irrigation, the sewage-irrigated area could be close to 1 million acres (based on a water requirement of 5 feet per year).

"Assuming further that 10 percent of the total domestic sewage production can be renovated by rapid-infiltration systems or other land-treatment systems that can take primary effluent, eliminating the secondary step will save $78 million per year in treatment costs and 86 million kilowatt-hours (kWh) in electricity," Bouwer says. That amount of power costs nearly $3.5 million at 4 cents a kWh.

"Considering the savings in treatment costs, the water reuse potentials, the fertilization of crops, the pollution abatement of surface water, and the simplicity and reliability of land-treatment systems, it is not surprising that such systems are on a rapid upswing in the United States," he adds.

The Environmental Protection Agency (EPA) is stimulating land-treatment by greater cost subsidies (85 percent instead of the customary 75 percent for conventional treatment plants), higher priority on state project lists, and system guarantees.

At the same time, plans for third stage treatment plants are increasingly being scrutinized as costs of construction, labor, chemicals, and energy continue to escalate. The performance of such plants has not always been satisfactory.

More research, requiring the talents of agricultural engineers, agronomists, soil scientists, and groundwater hydrologists, is needed to ensure that land-treatment systems can be designed and managed to maximize economic benefits and minimize adverse effects.

Dr. Bouwer's address is U.S. Water Conservation Laboratory, 4331 E. Broadway Rd., Phoenix, AZ 85040.—(By Paul Dean, SEA, Oakland, Calif.)

The recorded in-flow rate of secondary effluent is used to determine the system's hydraulic capacity (0879X1102-13).

Germ-free Pigs for Research

Very special pigs used for research at the National Animal Disease Center (NADC), Ames, Iowa, do not even smell like pigs.

They are germ-free—free not only of agents that cause disease, but also the normally innocuous ones on the skin or in nasal, gastrointestinal, and reproductive tracts. These natural inhabitants of healthy animals sometimes have a role in development of disease or may make precise laboratory procedures more difficult.

Germ-free laboratory animals are ideal research subjects in studies of mixed infections involving more than one agent, says SEA veterinary medical officer Shannon C. Whipp. The researcher can observe the effects of a single agent or a known combination with assurance that no other organism is affecting results.

"We have been unable to purchase germ-free pigs that remained uncontaminated until they reached our laboratory," Whipp says. So NADC has a surgical team trained to deliver germ-free animals. So far, about 20 litters of germ-free pigs have been delivered, as well as a few germ-free calves.

Whipp and SEA veterinary medical officer Peter J. Matthews observed and adopted procedures pioneered by Paul Miniats at the veterinary school of the University of Guelph in Canada.

Delivery is by Caesarean section to avoid contamination in the birth canal. Each pig is exposed to air in the operating room only long enough for the umbilical cord to be cut and tied. Then the still anesthetized pig is plunged through a germicidal bath into a sterile isolator, where it is revived. The pigs live in the sterile isolators while they are used in research projects.

The delivery room scene is not unlike that in a hospital: personnel wear gowns, caps, and face masks; the freshly washed sow is anesthetized, shaved, and scrubbed; the surgeon and nurse scrub and put on sterile gloves; the anesthetist monitors the sow while she is on the operating table; and attendants reach through gloves in the sides of the plastic-topped isolator to revive the pigs as they arrive through the germicidal bath.

Pigs are delivered on the 112th day of gestation—2 days before expected birth; calves about 6 days before end of term. The sows and cows are then returned to the herd to produce more offspring for research.

The surgical team organized by NADC's Physiopathology Laboratory and Animal Supply Section includes Matthews or Whipp, surgeon; Beverly W. Mullen, nurse; Robert W. Morgan, anesthetist; Deane F. Dennis, Roger J. Spaete, and Sydney K. Olson, assistants.

Using germ-free pigs, Whipp and Iowa State University veterinarian Delbert L. Harris confirmed the cause of swine dysentery, or bloody scours (Agricultural Research, February 1979, p. 7). They found that inoculating germ-free pigs with a pathogenic strain of the spirochete *Treponema hyodysenteriae* had no effect, but similar inoculation of farm-raised pigs produced scours.

Opposite: Roger Spaete, gnotobiotic technician, carefully scrubs and prepares a sow for a Caesarean section. Sterile surgical techniques are used as the sows are returned to the herd to produce more offspring (0979X1337-7A).

Above: The piglet's umbilical cord is clamped before cutting to prevent excessive bleeding. Veterinarian Peter Matthews and nurse Beverly Mullen operate (0979X1340-18A).

Whipp and Harris concluded that two agents, probably including one normally present in pigs, must together cause disease. And germ-free pigs infected with both *T. hyodysenteriae* and one or more anaerobic bacteria normally found in pigs' intestinal tracts did cause disease.

SEA veterinary medical officer Harley W. Moon uses germ-free calves in studies of a form of diarrhea involving both viral and bacterial agents. The germ-free subjects allows him to observe the effects of each agent alone or together.

And SEA microbiologist Phletus P. Williams turned to germ-free pigs for research on mycoplasmal pneumonia (Agricultural Research, February 1979, p. 12) because the mycoplasma are so widely distributed that most pigs either show lung lesions produced by mycoplasma or are inapparent carriers.

Dr. Harris' address is Department of Veterinary Medicine, Iowa State University, Ames, IA 50011. Dr. Whipp, Dr. Matthews, Dr. Moon, and Dr. Williams are located at the SEA National Animal Disease Center, P. O. Box 70, Ames, IA 50010.—(By Walter Martin, SEA, Peoria, Ill.)

Above: The sterile isolator is a 2'x3' stainless steel tub covered and sealed with a plastic canopy. The V-shaped trap is designed to prevent contaminated air from entering the isolator when filled with solution, in this case 10 percent tamed iodine. (0979X1339-13).

Right: The anesthetic given the sows passes the placental barrier and anesthetizes the piglets. They are passed through the germicidal bath into the sterile isolator where Sydney Olson, gnotobiotic technician, removes fluid from the respiratory tract and stimulates breathing by massaging the thorax (0979X1338-11).

Final Performance for a Tomato Disease

The long run of curly top virus as the most serious of all the tomato diseases in the Western United States may finally be coming to a close. Complete resistance to the disease has been found in wild tomato species, and the transfer of this resistance to domestic varieties is well underway.

Curly top completely prevents commercial tomato production in most areas of the West. Its partial control in other areas of the United States is economically and environmentally expensive.

For 50 years breeders have been trying to produce curly top resistant tomatoes: progress has been slow. A partial type resistance painstakingly incorporated into a few domestic cultivars permits tomato production where it was previously impossible. However, the resistance is too complex to be incorporated into other varieties and will succumb under severe disease exposure.

Searching for better and less genetically complex resistances, SEA plant pathologist Peter E. Thomas, Prosser, Wash., tested thousands of wild tomato species plants from South America. He found a few plants which, although infected with the virus, remained totally unaffected by the disease.

Initially this achievement seemed a touch hollow. These wild tomatoes are not really true tomatoes but are related to domestic tomatoes like donkeys are related to horses. Obtaining a fertile offspring from a cross between a wild tomato species and a domestic tomato species is like trying to get a reproductive mule.

Over a 3-year period, Thomas made thousands of attempts to cross the resistant wild tomatoes with leading domestic cultivars. Finally, a single cross with a Bonnie Best produced 16 fertile seed plants. The reason for this unique success among so many failures is still not fully understood.

Next, Thomas intercrossed these hybrid plants and on the third generation of hybrids he found a few plants with the complete resistance to curly top of the wild parent. Almost as important, the resistance is one of simple inheritance and will be easily transferred to other varieties.

Work is now underway to fully incorporate the curly top resistance into domestic tomato germplasm. Once this is achieved, tomato breeders can then readily place the resistance into the various tomato types desired by growers and consumers.

Dr. Thomas' address is the SEA Irrigated Agriculture Research and Extension Center, P.O. Box 30, Prosser, WA 99350.—(By Lynn Yarris, SEA, Oakland, Calif.)

Curly Top Tastes Better!

Tomato processors fearing the effects of curly top virus disease on their product can relax. A SEA study indicates the disease presents no problems in tomato juice processing, and it may even enhance the quality of the juice.

Curly top virus disease is one of the most serious tomato diseases, particularly in the Pacific Northwest where it prevents production in areas that otherwise would be good for growing tomatoes. The disease reduces yields and gives fresh fruit a poor flavor.

Tomato processors are concerned that poor-flavored fruits from infected plants will damage the quality of processed tomato products, especially tomato juice.

Tests conducted by SEA in cooperation with Washington State University at Pullman, should dispell this concern.

Fruits of the curly top resistant tomato variety "Roza" were harvested from both healthy and infected tomato plants. The juice was extracted, processed, and analyzed after 30 days of storage.

The analysis showed infected fruits to be superior to healthy fruits in soluble solids content, viscosity, color, and ascorbic acid content. When submitted to a 20-member taste panel, screened for their ability to distinguish between 100 percent infected juice and 100 percent healthy juice, 14 members (70 percent) preferred a processed product containing some juice taken entirely from infected plants.

The portion of juice from diseased fruit would rarely exceed 1 percent in commercial tomato juice. So even though the diseased portion would enhance the quality of the product, it most likely would never be detected by consumers at such low concentrations.

Geneticist Dr. Mark W. Martin and food technologist Dr. Stephen R. Drake conducted the study. They are located at the SEA Irrigated Agriculture Research and Extension Center, P.O. Box 30, Prosser, WA 99350.—(By Lynn Yarris, SEA, Oakland, Calif.)

The Microscopic World of Fungus

The cercospora leaf spot fungus remains in intercellular areas of sugarbeet leaves rather than actually entering individual cells, says SEA plant physiologist Susan S. Martin. As the fungus is killing cells, unusual dark material appears in the plant's nearby intercellular spaces.

This could be just a healing response similar to what might happen if the plant were damaged by cutting. Or it could be an effort by the plant to contain the fungus before it kills more cells.

"Fungus commonly robs cells to get energy for itself. Our microscopic studies reveal that when fungus attacks cells, plants sometimes react by forming thicker areas in their cell walls. This means plants are doing something to defend themselves against infection," says Martin.

Knowledge of how plants respond to disease infections increases the chances that plant breeders will be able to develop more resistant varieties. Martin uses an electron microscope—at magnifications up to 35,000 times normal size—to study sugarbeet response to cercospora leaf spot infections.

Cercospora leaf spot can completely destroy sugarbeets in severe infections. Beets expend energy replacing diseased and dead leaves at the expense of root yield and sugar content.

"We have seen that individual plant cells surrounding a leaf spot fungus die. How and why they die is what we are exploring. So far we have seen that the membranes enclosing the nucleus, mitochondria, chloroplasts, and other cell organelles disappear, and the organization of the cell is lost," says Martin.

Martin is currently identifying individual chemicals that the fungus makes as part of its attack, and chemicals the sugarbeet manufactures to protect itself, in this internal "biochemical warfare."

Dr. Martin's address is Crops Research Laboratory, Colorado State University, Ft. Collins, CO 85023.—(By Dennis Senft, SEA, Oakland, Calif.)

Sugarbeet Resistance to Storage Rot

A sugar factory could have recovered about 2.8 million more pounds of sucrose from 280,000 tons of sugarbeets had they been protected against storage rots with the fungicide thiabendazole or been genetically resistant to the rots.

These estimates by SEA plant pathologist William M. Bugbee, Fargo, N. Dak., are based on results comparing genetically resistant breeding lines and susceptible commercial hybrids, with and without fungicide dipping, under field conditions.

The estimates are possible because untreated, susceptible hybrids in one test developed about the same amount of rot as was found in rot-susceptible roots held more than 100 days at a sugar processing factory.

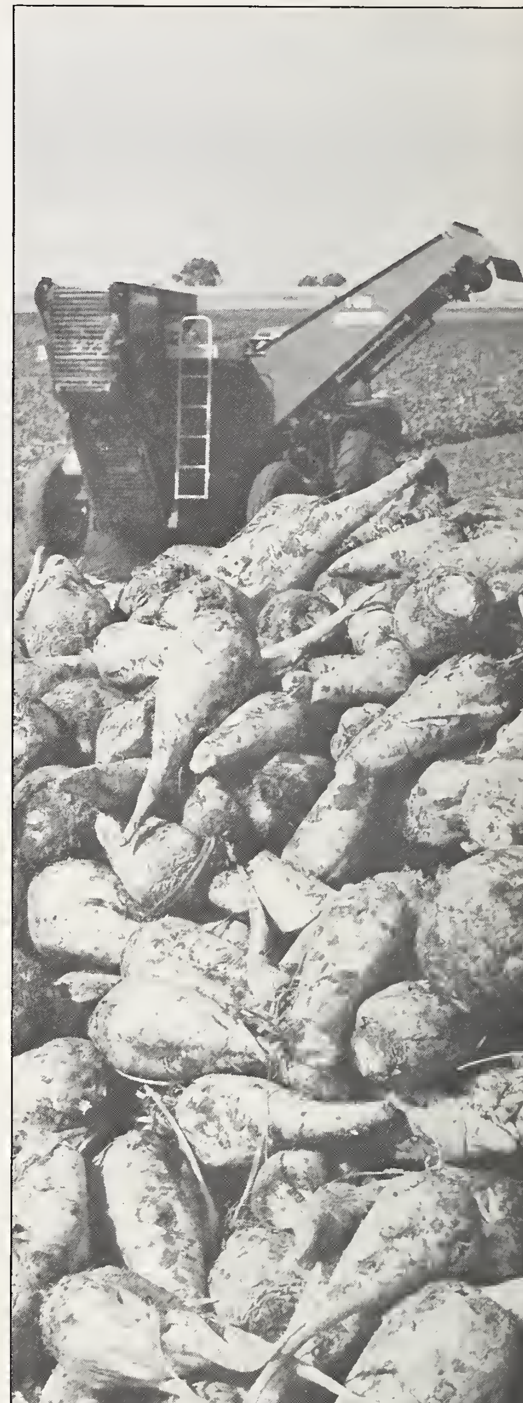
Thiabendazole treatment reduced storage rot to a trace amount in susceptible hybrids after 100 days of storage. Rot in the genetically resistant breeding lines was nearly as low.

The research by Bugbee and SEA plant physiologist Darrell F. Cole suggests the level of protection that is possible against rot-caused sucrose losses when genetic resistance has been incorporated in cultivars acceptable to the industry.

Two breeding lines developed by Bugbee and released to breeders in 1977 (Agricultural Research, December 1977, pp. 6-7) carry high levels of resistance to *Phoma betae*, the chief fungal cause of sugarbeet storage rot in this country, as well as moderate resistance to *Botrytis cinerea* and *Penicillium claviforme* rots.

An approved fungicidal treatment would be valuable to the industry, the scientist says, but experience with other crops indicates that genetic resistance controls disease at less cost to growers—and without questions on environmental safety.

Thiabendazole is not generally available for use on sugarbeets. The Environmental Protection Agency, however, has granted an exemption to registered uses of thiabendazole in Washington, Idaho, and Michigan for treating 400,000 tons of sugarbeet roots.



Dr. Bugbee is located at 306E Walster Hall and Dr. Cole at 210 Waldron Hall, North Dakota State University, Fargo, ND 58105.—(By Walter Martin, SEA, Peoria, Ill.)

Salvaging the Sugarbeet Industry

A teetering U.S. sugarbeet industry could be restored to firm financial foundations if harvesting, handling, and storage procedures are redesigned to minimize root injury. SEA studies show that root injuries determine sugarbeet storage life and cutting down on these injuries could save the U.S. sugarbeet industry millions of dollars annually.

Over 30 million tons of sugarbeets are produced in this country each year, and about 60 percent of the crop is stored for extended periods prior to processing. In most sugarbeet growing areas, the crop must be harvested within 20-30 days. For this reason, mechanical harvesting equipment has been designed solely to handle large volumes of sugarbeets efficiently with little regard for the amount of damage inflicted on the roots.

Research on sugarbeet storage problems indicates that mechanical harvest injury can cause a 380 percent increase in sucrose losses over losses experienced in hand-harvested and handled beets.

According to plant physiologist Roger E. Wyse, of the SEA Sugarbeet Research Laboratory, Logan, Utah, the increase is due to mold growth at the injured spot that increases respiration rate and impurity accumulation while a beet is held in storage.

Although mold can occur when the beet is bruised during handling, most mold is caused by removal of the crown during mechanical harvesting. When a beet is machine-harvested, the root is scooped up and separated from the leaves by being sliced at the crown. Removal of the crown exposes an area in the center of the root, called the pith, to air.

The pith is very susceptible to infection by molds, which, once established, spread and rot the rest of the root. The swiftness with which the rot spreads is determined by the length of the beet's storage time.

"The practice of crown removal has been perpetuated on the premise that the crown contains high levels of impurities," says Wyse.

"Although quality at harvest may be improved by crown removal, the evidence is now quite clear that any advantages to crown removal at harvest are readily negated by increased storage losses."

Since over 60 percent of U.S. sugarbeets are stored for at least 30 days, Wyse suggests eliminating crown removal operations from all beets destined to be stored for a longer time. However; he does caution that if the crown is not removed, all leafy material must be carefully removed to avoid trash-filled piles.

Wyse projects that minimizing damage would reduce sucrose losses by 25 percent and that a further 25 percent savings could be realized by redesigning storage methods. Currently, sugarbeets are stored in piles approximately 25 feet high, 200 feet wide, and a quarter of a mile long. Beets are sometimes stored in these piles up to 150 days and may suffer a 20 percent loss in sucrose unless mold growth is checked.

Mold growth can be checked either by treating it with fungicides, now being used commercially on a trial basis, or rapidly lowering pile temperatures and maintaining the coolness through ventilation.

Plastic covers spread across a pile's surface can be used to maintain low temperatures while protecting beets from freezing or thawing.

Wyse and fellow SEA researchers at Logan, have put together a computerized simulation model that analyzes a given pile to determine the best and most economical way to cool it. In tests so far, the computerized simulation model has turned in stellar performances.

Right now the U.S. sugarbeet industry is in trouble. Sugar is cheap on the world market and can be imported at lower prices than our industry can produce it here. Wyse argues that by taking into consideration the effects of harvest and handling injuries on sugarbeet sucrose in storage, the industry may be able to save enough money annually to become competitive with the world market.

Dr. Wyse's address is the SEA Sugarbeet Research Laboratory, Room 112, Agri. Sci. Bldg., Utah State University, Logan, UT 84322.—(By Lynn Yarris, SEA, Oakland, Calif.)

Sucrose from Sugarbeets

Wanted: Sugarbeets with more vascular tissue in the root and less pith tissue in the crown.

Selecting for these characteristics in sugarbeet breeding should reduce the levels of impurities that interfere with sucrose extraction from harvested roots. This would increase sucrose recovery at the factory, says SEA plant physiologist Darrell F. Cole.

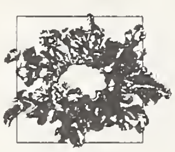
Cole found that the impurities—sodium, potassium, amino acids, and reducing sugars—are located in tissues where sucrose is the lowest. The specific locations of these impurities in the roots had not been defined before his studies.

The highest concentrations of reducing sugars and sodium were in parenchyma cells located between vascular rings near the center of the root. Potassium and amino acids were highest in the pith tissue of the crown.

Sucrose content is also influenced by environmental conditions and by such cultural practices as nitrogen fertilization, planting date, cultivar, row width, and plant population.

Dr. Darrell F. Cole is located at 210 Waldron Hall, North Dakota State University, Fargo, ND 58105.—(By Walter Martin, SEA, Peoria, Ill.).

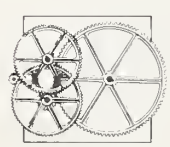

Animal Science



Crops


Diseases

Energy



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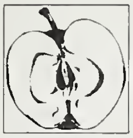
Insects

Marketing



Nutrition

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Soil and Water

Agrisearch Notes

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Agrisearch Notes

A Delicious New Fruit Juice— Researchers have developed a carrot-passion fruit juice beverage, made from unmarketable carrots, that is both delicious and nutritious.

Carrot and passion fruit juices are compatible in flavor, making this new beverage a distinct product.

Four beverages, prepared using different amounts of carrot juice, passion fruit juice, sugar, and water were analyzed for composition and flavor. The carrot juice was extracted from two different varieties of carrots, Danvers and Imperator. Passion fruit juice was obtained from a commercial source. The ingredients in the beverages were then heated and processed. Canned plain carrot juice served as a control sample.

A nutritional analysis revealed that there was more *beta*-carotene in beverages made from the Danvers variety than from Imperator. Beverages prepared from Imperator contained more ascorbic acid, niacin, and thiamine and had a higher caloric value than beverages made from Danvers.

Beverages made from either Imperator or Danvers, containing 60 percent carrot juice, 15 percent passion fruit juice, 7 percent sugar, and 18 percent water, scored 6.4 on a 9 point Hedonic scale. The nine member taste panel gave plain carrot juice a score of 3.

Guadalupe Saldana, Thomas S. Stephens, Robert Meyer, and Bruce J. Lime conducted the research. Their address is P.O. Box 388, Weslaco, TX 78596.—(By Eriks Likums, SEA, New Orleans, La.)

Cattle Grub Control. Researchers have achieved 100 percent protection against cattle grubs by using plastic strips impregnated with dichlorvos.

The plastic strips are attached around the heels, or hocks, of the cattle during heel fly season, when female heel flies lay eggs on hair about the animals' heels.

SEA chemist LaWanda M. Hunt says that female heel flies (also called warble flies and gad flies) are active 3 to 4 months each year.

During these months, the flies lay eggs which hatch into tiny larvae or maggots. These larvae then burrow under the skin and travel up to the animal's back where they form ugly sellings or "warbles." The maggots produce a powerful enzyme which creates holes in the hides of the cattle. If there are more than five holes in a hide, it is downgraded in market value. More importantly, the meat near the warbles must be cut away at slaughter and much of the best meat on the animal is lost.

Entomologist Roger O. Drummond says that available systemic insecticides will control the cattle grub by killing it as it migrates through the animal's body. However, systemic insecticides are not registered in the United States for use on lactating (milk producing) dairy cattle or on calves less than 3 months old.

"Dichlorvos," Drummond says, "has been approved by EPA as a spray for dairy and young cattle. Also, the amount of dichlorvos used in the strips is very little, 5 grams per strip, and is much less than the amount already approved in the spray.

"What we are talking about," Drummond continued, "is a controlled release mechanism that is simple, easy to use, cheap, and can give us complete control of this very serious pest of cattle. Treated strips of plastic also controlled the horn fly, another serious pest."

This new method of cattle grub control is a result of a 2-year study. "Apparently," says Drummond, "the dichlorvos in the plastic gives off a vapor that kills the eggs on the hair of the cattle so that no infestation occurs."

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